

WHAT IS CLAIMED IS:

- 1 1. A method of operating a substrate processing chamber, the
2 method comprising:
3 transferring a first substrate into the substrate processing chamber and
4 heating the substrate to a first temperature of at least 510°C;
5 depositing an insulating layer over the first substrate while reducing the
6 temperature of the substrate from the first temperature to a second temperature that is
7 lower than the first temperature;
8 transferring the first substrate out of the substrate processing chamber;
9 removing unwanted deposition material formed on interior surfaces of
10 the chamber during the depositing step by introducing reactive halogen species into the
11 chamber while increasing the temperature of chamber;
12 transferring a second substrate into the substrate processing chamber and
13 heating the substrate to the first temperature; and
14 depositing an insulating layer over the second substrate while reducing
15 the temperature of the substrate from the first temperature to the second temperature.
- 1 2. The method of claim 1 wherein the second temperature is at least
2 30°C lower than the first temperature.
- 1 3. The method of claim 1 wherein the second temperature is at least
2 50°C lower than the first temperature.
- 1 4. The method of claim 1 wherein the temperature of the chamber
2 is increased at least 30°C during the removing step.
- 1 5. The method of claim 1 wherein the insulating layer comprises
2 silicon oxide.
- 1 6. The method of claim 1 wherein each depositing step includes
2 first substep of depositing an initial portion of the insulating layer over the first and
3 second substrates, respectively, at the first temperature.

1 7. The method of claim 1 wherein the insulating layer deposited
2 during each depositing step is deposited within trenches formed for a shallow trench
3 isolation structure on an integrated circuit.

1 8. A method of operating a substrate processing chamber having a
2 substrate heater, the method comprising:

3 transferring a first substrate into the substrate processing chamber and
4 heating the heater to a first set point that causes the substrate to be heated to a first
5 temperature of at least 510°C;

6 depositing an insulating layer over the first substrate while reducing the
7 temperature of the heater to a second set point thereby reducing the temperature of the
8 substrate from the first temperature to a second temperature that is lower than the first
9 temperature;

10 transferring the first substrate out of the substrate processing chamber;

11 removing unwanted deposition material formed on interior surfaces of
12 the chamber during the depositing step by introducing reactive halogen species into the
13 chamber while increasing the temperature of the heater from a third set point that is
14 lower than the first set point to a fourth set point that is lower than the first set point;

15 transferring a second substrate into the substrate processing chamber and
16 heating the heater to the first set point substrate to the first temperature; and

17 depositing an insulating layer over the second substrate while reducing
18 the temperature of the substrate from the first temperature to the second temperature.

1 9. The method of claim 1 wherein the second temperature is at least
2 30°C lower than the first temperature.

1 10. The method of claim 1 wherein the second temperature is at least
2 50°C lower than the first temperature.

1 11. The method of claim 1 wherein the temperature of the chamber
2 is increased at least 30°C during the removing step.

1 12. The method of claim 1 wherein the insulating layer comprises
2 silicon oxide.

1 13. The method of claim 12 wherein the insulating layer is deposited
2 from a process gas comprising ozone and TEOS.

1 14. The method of claim 13 wherein the silicon oxide layer is doped
2 with phosphorus.

1 15. The method of claim 8 wherein the substrate is heated by a
2 substrate heater embedded in a ceramic pedestal during the removing step.

1 16. The method of claim 8 wherein each depositing step includes
2 first substep of depositing an initial portion of the insulating layer over the first and
3 second substrates, respectively, at the first temperature.

1 17. The method of claim 8 wherein the insulating layer deposited
2 during each depositing step is deposited within trenches formed for a shallow trench
3 isolation structure on an integrated circuit.

1 18. A method of operating a substrate processing chamber of the
2 type used to fabricate integrated circuits, the method comprising:
3 transferring a first substrate into the substrate processing chamber;
4 depositing a silicon oxide film over the first substrate by introducing
5 TEOS and ozone gases into the chamber and maintaining the chamber at a pressure of
6 between about 45 to 700 Torr, wherein the depositing step includes forming a first
7 portion of the silicon oxide film while heating the substrate to a temperature of at least
8 510°C using a substrate heater and forming a second portion of the silicon oxide film
9 over the first portion while reducing the temperature of the substrate;
10 transferring the substrate out of the chamber;
11 thereafter, removing unwanted deposition material from interior surfaces
12 of the chamber by introducing a fluorine-containing etchant gas into the chamber;
13 during the removing step, ramping up the temperature of the substrate
14 heater to increase the chamber temperature;
15 transferring a second substrate into the substrate processing chamber;
16 and
17 depositing a silicon oxide film over the second substrate disposed by
18 introducing TEOS and ozone gases into the chamber and maintaining the chamber at a

19 pressure of between about 45 to 700 Torr, wherein the depositing step includes forming
20 a first portion of the silicon oxide film while heating the substrate to a temperature of at
21 least 510°C using a substrate heater and forming a second portion of the silicon oxide
22 film over the first portion while reducing the temperature of the substrate.

1 19. The method of claim 18 wherein the second temperature is at
2 least 30°C lower than the first temperature.

1 20. The method of claim 18 wherein the second temperature is at
2 least 50°C lower than the first temperature.

1 21. The method of claim 19 wherein the temperature of the chamber
2 is increased at least 30°C during the removing step.

1 22 The method of claim 21 wherein during each depositing step the
2 deposited silicon oxide layer is doped with phosphorus.

1 23. The method of claim 21 wherein the substrate is heated by a
2 substrate heater embedded in a ceramic pedestal during the removing step.

1 24. The method of claim 21 wherein the silicon oxide layer
2 deposited during each depositing step is deposited within trenches formed for a shallow
3 trench isolation structure on an integrated circuit.